

**REMARKS**

The Final Office Action mailed February 6, 2008, has been received and reviewed. Claims 1, 3 through 22, 24 through 27, 31 through 40, 42, and 43 are currently pending in the application. Claims 1, 3 through 22, 24 through 27, 31 through 40, 42, and 43 stand rejected. Applicants propose to amend claims 1, 5, 6, 7, 9, 11, 14, 18, 24, 25, 26, 27, 31, 35-40, 42 and 43. The amendments to claims 6, 9, 11, 27, 36, 37, 39 and 40 correct claim informalities and grammatical errors. No new matter is added. Reconsideration is respectfully requested.

**Claim Objections**

Claims 11, 42, and 43 are objected to due to informalities in the claim language. Appropriate correction has been made to claim 11. With respect to claims 42 and 43, Applicants submit the two clauses are different as shown:

“heat treating the oxide layer, first spacer, second spacer and conformal second layer of the **first** isolation structure to fuse the oxide layer, first spacer, second spacer and conformal second layer of the **first** isolation structure”

“heat treating the oxide layer, first spacer, second spacer and conformal second layer of the **second** isolation structure to fuse the oxide layer, first spacer, second spacer and conformal second layer of the **second** isolation structure”

Reconsideration and withdrawal of the objections is requested.

**Specification**

The amendment filed November 13, 2007, was objection to as allegedly introducing new matter. Specifically, it was thought that the amendment adding “etching may be performed using an etch recipe that etches the isolation film 36 and spacer 28 faster than the isolation structure 48 by a ratio in a range of from about 1:1 to about 2:1, more specifically, by a ratio of about 1.3:1 to about 1.7:1” introduced new matter because the isolation film 36 and spacer 28 comprise the isolation structure 48. Applicants respectfully traverse the rejection.

Applicants have amended the specification to correct this typographical error. Paragraph [0051] now recites, in part, “etching may be performed using an etch recipe that etches the

~~isolation film 36 and spacer 28 reduced island 52~~ faster than the isolation structure 48 by a ratio in a range of from about 1:1 to about 2:1, more specifically, by a ratio of about 1.3:1 to about 1.7:1.”

It is noted that “[t]he claims as filed in the original specification are part of the disclosure and therefore, if an application as originally filed contains a claim disclosing material not disclosed in the remainder of the specification, the applicant may amend the specification to include the claimed subject matter.” M.P.E.P. §2163.06 (III)

Furthermore, M.P.E.P. §608.01(I) provides:

“[i]n establishing a disclosure, applicant may rely not only on the description and drawing as filed but also on the original claims if their content justifies it. Where subject matter not shown in the drawing or described in the description is claimed in the application as filed, and such original claim itself constitutes a clear disclosure of this subject matter, then the claim should be treated on its merits, and requirement made to amend the drawing and description to show this subject matter. The claim should not be attacked either by objection or rejection because this subject matter is lacking in the drawing and description. It is the drawing and description that are defective, not the claim.”

Claims 12 and 13 of the current application recite subject matter that was included in the priority application. Specifically, this application claims priority to, and incorporates by reference, U.S. Patent Application No. 08/823,609, now U.S. Patent 6,097,076. Claims 10 through 12 as-filed specification of U.S. Patent 6,097,076 provide support for present claims 12 and 13. Thus, the current amendment does not introduce new matter to the pending application. Reconsideration and withdrawal of the objection is requested.

### **35 U.S.C. § 112 Claim Rejections**

Claims 1, 3 through 22, 24 through 27, 31 through 40, 42, and 43 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. The claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains or with which it is most nearly connected, to make and/or use the invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Specifically, the Examiner objected to the amendment to paragraph [0051] of the specification that was filed on November 13, 2007. As stated herein, Applicants have amended the

specification to correct this typographical error identified by the Examiner. Paragraph [0051] now recites, in part, "etching may be performed using an etch recipe that etches the ~~isolation film 36 and spacer 28~~ reduced island 52 faster than the isolation structure 48 by a ratio in a range of from about 1:1 to about 2:1, more specifically, by a ratio of about 1.3:1 to about 1.7:1." Reconsideration and withdrawal of the rejection is requested.

Claims 9, 10, 12, and 13 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Claim 9 is proposed to be amended to recite "The method according to ~~Claim~~ claim 7, wherein removing ~~material from the plurality of exposed areas at locations between adjacent portions of the plurality of spacers~~ portions of the conformal layer comprises etching the material using an etch recipe that etches the conformal layer faster than the first dielectric layer by a ratio in a range from about 1:1 to about 2:1." The amendment is supported by the as-filed specification, for example, paragraph [0048]. Claim 10 depends from claim 9, but does not include the rejected language. Reconsideration and withdrawal of the rejection is requested.

With respect to claims 12 and 13, it is noted that "[t]he claims as filed in the original specification are part of the disclosure and therefore, if an application as originally filed contains a claim disclosing material not disclosed in the remainder of the specification, the applicant may amend the specification to include the claimed subject matter." M.P.E.P. §2163.06 (III)

Furthermore, M.P.E.P. §608.01(I) provides:

"[i]n establishing a disclosure, applicant may rely not only on the description and drawing as filed but also on the original claims if their content justifies it. Where subject matter not shown in the drawing or described in the description is claimed in the application as filed, and such original claim itself constitutes a clear disclosure of this subject matter, then the claim should be treated on its merits, and requirement made to amend the drawing and description to show this subject matter. The claim should not be attacked either by objection or rejection because this subject matter is lacking in the drawing and description. It is the drawing and description that are defective, not the claim."

Claims 12 and 13 of the current application recite subject matter that was included in the

priority application. Specifically, this application claims priority to, and incorporates by reference, U.S. Patent Application No. 08/823,609, now U.S. Patent 6,097,076. Claims 10 through 12 as-filed specification of U.S. Patent 6,097,076 provide support for present claims 12 and 13.

Applicants have amended the specification to include the subject matter of original claims 10-12 from the as-filed specification of U.S. Patent 6,097,076. Paragraph [0051] now recites, in part, "etching may be performed using an etch recipe that etches the ~~isolation film 36 and spacer 28~~ reduced island 52 faster than the isolation structure 48 by a ratio in a range of from about 1:1 to about 2:1, more specifically, by a ratio of about 1.3:1 to about 1.7:1." Thus, the current amendment does not introduce new matter to the pending application and the specification supports claims 12 and 13 of the presently claimed invention. Reconsideration and withdrawal of the rejection is requested.

Claims 1, 7, 14, 18, 24 through 26, 31, 35, 38, 42, and 43 (all independent claims) stand rejected under 35 U.S.C. § 112 for being similar in nature. Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicants respectfully submit that each of the independent claims include unique combination of elements and limitations. Thus, the scope of each independent claim is different. By way of comparison with independent claim 1 of the presently claimed invention, each independent claim differs at least as follows:

Claim	
7	Further includes the element of "rounding the top edge of each of the isolation trenches"
14	Recites "forming a <i>silicon nitride</i> layer upon the oxide layer" and "forming a first <i>silicon dioxide</i> layer over the <i>silicon nitride</i> layer"
18	Further includes the elements of "rounding the top edge of each of the isolation trenches " and "forming a polysilicon layer upon the oxide layer"
24	Further includes the element of "forming a polysilicon layer upon the oxide layer"
25	Further includes the elements of "rounding the top edge of each of the isolation trenches," "forming a polysilicon layer upon the oxide layer,"

	and “forming a gate oxide layer upon the portion of the semiconductor substrate”
26	Further includes the elements of “forming a polysilicon layer upon the oxide layer” and “using an etch recipe that etches the third conformal layer and the spacers faster than the first dielectric layer by a ratio of about 1:1 to about 2:1”
31	Further includes “forming a <i>silicon nitride</i> layer upon the <i>polysilicon</i> layer,” “forming a first <i>silicon dioxide</i> layer over the <i>polysilicon nitride</i> layer” and “rounding the top edge of each of the isolation trenches”
35	Further includes the element of “forming a polysilicon layer upon the oxide layer” and “wherein the planar upper surface is formed by substantially simultaneously subjecting the entire upper surface contour of the second layer to a planarizing process”
38	Recites “forming a <i>first</i> layer upon an oxide layer” and further includes “forming a plurality of isolation trenches through the oxide layer at a plurality of areas, wherein an electrically insulative material extends continuously between and within the plurality of isolation trenches without filling the plurality of isolation trenches”
42	Further includes the elements of “forming a polysilicon layer upon the oxide layer,” forming first and second isolation structures, “rounding the top edges of the isolation trenches” and “forming an active area located within the semiconductor substrate”
43	Further includes the elements of “forming a <i>first</i> layer upon the oxide layer,” forming first and second isolation structures, “rounding the top edges of the isolation trenches” and “forming an active area located within the semiconductor substrate”

Reconsideration and withdrawal of the rejection is requested.

Claims 14 through 17 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicants have amended claim 14 to provide correct antecedent basis. Reconsideration and withdrawal of the rejection is requested.

### **35 U.S.C. § 103(a) Obviousness Rejections**

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor in view of U.S.

Patent No. 5,858,858 to Park et al.

Claims 1, 3, 6 through 15, 17 through 19, 21, 22, 24 through 26, 35, 38, 42, and 43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) in view of Park et al. (U.S. Patent No. 5,858,858). Applicants respectfully traverse this rejection, as hereinafter set forth.

To establish a *prima facie* case of obviousness the prior art reference (or references when combined) **must teach or suggest all the claim limitations**. *In re Royka*, 490 F.2d 981, 985 (CCPA 1974); *see also* MPEP § 2143.03. Additionally, the Examiner must determine whether there is “an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741, 167 L.Ed.2d 705, 75 USLW 4289, 82 U.S.P.Q.2d 1385 (2007). Further, rejections on obviousness grounds “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Id* at 1741, quoting *In re Kahn*, 441, F.3d 977, 988 (Fed. Cir. 2006). To establish a *prima facie* case of obviousness there must be a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). Furthermore, the reason that would have prompted the combination and the reasonable expectation of success must be found in the prior art, common knowledge, or the nature of the problem itself, and not based on the Applicant’s disclosure. *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006); MPEP § 2144. Underlying the obvious determination is the fact that statutorily prohibited hindsight cannot be used. *KSR*, 127 S.Ct. at 1742; *DyStar*, 464 F.3d at 1367.

Omid-Zohoor discloses a method of forming trenches with suppressed parasitic edge transistors. Trenches 360 are formed in a substrate 120 having a pad oxide layer 340 and silicon nitride layer 344 thereon. (Omid-Zohoor, FIG. 3I). Spacers 356 may flank the trenches 360. A thick oxide layer 364 is deposited to cover the wafer and fill the trenches 360. A reverse mask 368 is placed over defined trench regions. The mask is followed by an etch which creates oxide ridges. (Omid-Zohoor, col. 4, lines 47-55, FIG. 3L). The upper surface of the oxide layer 372 is polished to expose the silicon nitride layer 344. (*Id.*, FIG. 3M). Park is cited for teaching the formation of a liner along the sidewall of a trench and for heat treatment to densify the conformal

layer. (Office Action mailed February 6, 2008, page 8). Applicants respectfully submit the proposed combination of references fail to teach or suggest each and every limitation of the presently claimed invention.

Specifically, each of independent claims 1, 7, 14, 18, 24 through 26, 35 38, 42, and 43 include a similar limitation of “implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide layer.” Support for the amendment may be found throughout the as-filed specification including, for example, paragraph [0043] of the as-filed specification. Applicants note that Poon, discussed herein, was cited for teaching the formation of a doped region below the termination of each isolation trench. (Office Action, mailed February 6, 2008, page 36). However, Poon lacks any teaching or suggestion of implanting ions in a direction substantially orthogonal to a plane of the oxide layer. Instead, Poon lacks any specific teaching regarding a method of doping. (Poon, col. 2, lines 52-66). By contrast, the as-filed specification of the above-entitled application provides that “Slightly angled implantation of P-implantation ions may be carried out to enrich or broaden the occurrence of P-doping ions in doped trench bottom 34 at the bottom of isolation trench 32.” Thus, Poon does not cure the deficiencies of Omid-Zohoor and Park.

Since the cited references do not teach or suggest all of the claim limitations, it is respectfully submitted that the combination of Omid-Zohoor in view of Park does not support a *prima facie* case of obviousness of independent claims 1, 7, 14, 18, 24-26, 35, 38, 42 and 43. Reconsideration and withdrawal of the rejection is requested.

Each of claims 3 and 6, 8 through 13, 15, 17, 19, and 22 are allowable, at least, as depending from an allowable base claim.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor in view of U.S. Patent No. 5,387,540 to Poon et al. and U.S. Patent No. 5,858,858 to Park et al.

Claims 31 through 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) in view of Poon et al. (U.S. Patent No. 5,387,540) and Park et al. (U.S. Patent No. 5,858,858). Applicants respectfully traverse this rejection, as hereinafter set forth.

The prior discussion of Omid-Zohoor and Park is incorporated herein. Poon is cited for teaching the formation of a doped region below the termination of each isolation trench. (Office Action, mailed February 6, 2008, page 36). Applicants respectfully submit the proposed combination of references fail to teach or suggest every element of the presently claimed invention.

Independent claim 31 of the presently claimed invention recites “A method of forming a microelectronic structure, the method comprising: forming a pad oxide layer upon a semiconductor substrate; forming a polysilicon layer upon the oxide layer; forming a silicon nitride layer upon the polysilicon layer; selectively removing the silicon nitride layer and the polysilicon layer to expose a plurality of areas of the oxide layer; forming a first silicon dioxide layer over the silicon nitride layer and in contact with the exposed oxide layer at the plurality of exposed areas of the oxide layer; selectively removing the first silicon dioxide layer to form a plurality of spacers at peripheral edges of the plurality of exposed areas of the oxide layer in contact with lateral edges of the silicon nitride layer and the polysilicon layer; removing a portion of material from the plurality of exposed areas at locations between adjacent portions of the plurality of spacers to form a plurality of isolation trenches extending into and terminating within the semiconductor substrate, wherein each isolation trench of the plurality of isolation trenches is adjacent to and below a pair of the spacers and is situated at a corresponding area of the plurality of areas; forming a corresponding doped region below the termination of each isolation trench within the semiconductor substrate by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide layer; forming a liner upon a sidewall of each isolation trench, each liner extending from an interface thereof with the oxide layer to the termination of the isolation trench within the semiconductor substrate; rounding the top edges of the isolation trenches; depositing a conformal second layer filling each isolation trench, the conformal second layer extending over remaining portions of the oxide layer in contact with a corresponding pair of the spacers, wherein depositing is carried out to the extent of filling each isolation trench and extending over the spacers and over the silicon nitride layer so as to define an upper surface contour of the conformal second layer; removing a portion of the conformal second layer by planarizing the conformal second layer and each of the spacers to form an upper



surface for each isolation trench that is co-planar to the other upper surfaces and is situated above the oxide layer; and heat treating the oxide layer, liner, spacers and conformal second layer to fuse the oxide layer, liner, spacers and conformal second layer; wherein a material that is electrically insulative extends continuously between and within the plurality of isolation trenches.” Support for the amendment may be found throughout the as-filed specification including, for example, paragraph [0043].

Applicants submit the combination of Omid-Zohoor, Poon and Park fails to teach or suggest every element of the presently claimed invention. Specifically, the references fail to teach or suggest “forming a corresponding doped region below the termination of each isolation trench within the semiconductor substrate by implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide layer.” Omid-Zohoor and Park lack any teaching or suggestion about doping isolation trenches. Poon merely discloses that “a portion of silicon substrate 12 underlying trench bottom surface 26 may also be implanted with ions to form a channel stop region 30 adjacent to trench bottom 26.” (Poon, col. 2, lines 62-63). However, Poon lacks any teaching or suggestion of any method of implanting, such as forming a corresponding doped region below the termination of each isolation trench within the semiconductor substrate “implanting ions in the plurality of isolation trenches in a direction substantially orthogonal to a plane of the oxide layer” as recited in claim 31 of the presently claimed invention.

The as-filed specification of the above-entitled application provides that “Slightly angled implantation of P-implantation ions may be carried out to enrich or broaden the occurrence of P-doping ions in doped trench bottom 34 at the bottom of isolation trench 32.” Thus, Poon does not cure the deficiencies of Omid-Zohoor and Park. Since the cited references do not teach or suggest all of the claim limitations, it is respectfully submitted that the combination of Omid-Zohoor in view of Poon and Park does not support a *prima facie* case of obviousness of independent claim 31. Reconsideration and withdrawal of the rejection is requested.

Each of claims 32 through 34 are allowable, at least, as depending from an allowable base claim.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor in view of U.S.

Patent No. 5,387,540 to Poon et al. and U.S. Patent No. 5,858,858 to Park et al.

Claims 4, 5, 16, and 20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) in view of Park et al. (U.S. Patent No. 5,858,858) as applied to claims 1, 14, and 18 and Poon et al. (U.S. Patent No. 5,387,540). Applicants respectfully traverse this rejection, as hereinafter set forth.

The prior discussion of Omid-Zohoor, Poon and Park is incorporated herein. The Court of Appeals for the Federal Circuit has stated that “dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious.” In re Fine, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). See also MPEP § 2143.03. Having failed to teach or suggest each and every limitation of the current application, the prior art referenced as rendering dependent claims 4, 5, 16, and 20 obvious, cannot serve as a basis for rejection.

Obviousness Rejection Based on U.S. Patent No. 6,097,072 to Omid-Zohoor and U.S. Patent No. 5,858,858 to Park et al., and further in view of Wolf, Silicon Processing for the VLSI Era, Vol. 2, pp. 54-55

Claims 36, 37, and 40 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Omid-Zohoor (U.S. Patent No. 6,097,072) and Park et al. (U.S. Patent No. 5,858,858) as applied to claims 35 and 38 above, and further in view of Wolf, Silicon Processing for the VLSI Era, Vol. 2, pp. 54-55. Applicants respectfully traverse this rejection, as hereinafter set forth.

The prior discussion of Omid-Zohoor and Park is incorporated herein. Wolf is cited for teaching that the top edge of an isolation trench may be rounded and that the semiconductor substrate may be doped. Wolf fails to cure the deficiencies of Omid-Zohoor. Applicants respectfully submit the proposed combination of references fails to teach or suggest all of the limitations of the presently claimed invention

The Court of Appeals for the Federal Circuit has stated that “dependent claims are nonobvious under section 103 if the independent claims from which they depend are nonobvious.” In re Fine, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988). See also MPEP § 2143.03. Having failed to teach or suggest each and every limitation of the current application, the prior art referenced as rendering dependent claims 36, 37 and 40 obvious, cannot serve as a basis for

rejection.

### ENTRY OF AMENDMENTS

The proposed amendments to claims 1, 5, 6, 7, 9, 11, 14, 18, 24, 25, 26, 27, 31, 35-40, 42 and 43 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application. Further, the amendments do not raise new issues or require a further search. Finally, if the Examiner determines that the amendments do not place the application in condition for allowance, entry is respectfully requested upon filing of a Notice of Appeal herein.

### CONCLUSION

Claims 1, 3 through 22, 24 through 27, 31 through 40, 42, and 43 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney:

Respectfully submitted,



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